REMARKS

The Office Action of March 27, 2003, is discussed in detail below.

Claim Amendments

Applicant has amended claim 1 to indicate that the coordinatively irregular structures of applicant's semiconductor material show a distortion from a regular tetrahedral bonding configuration. Support for the amendment to claim 1 may be found, for example, on p. 8, lines 14 – 16 of applicant's specification as filed.

Applicant has canceled claims 21 – 30 in response to the Examiner's restriction requirement (Paragraph 1 of Office Action).

Claim 31 has been amended as to form in light of the restriction requirement. The amended form of Claim 31 includes the process features of original claim 21. The amended form of claim 31 further includes a specific recitation that the semiconductor body of the claim comprises coordinatively irregular structures as well as features of those structures as indicated in amended claim 1. Support for this recitation is found throughout the specification as filed (see, for example, p. 19, line 10 through p. 20, line 5 and p. 20 lines 13 – 15).

Applicant has added new claims 35 – 38 directed to the bandgap energy and refractive index of applicant's semiconductor material. Support for the bandgap range recited in new claim 35 may be found on p. 28, lines 7 – 12 and in Fig. 1 of applicant's originally filed specification. Support for the refractive index limitations recited in new claims 36 – 38 may be found on p. 34, lines 10 – 13 and in Fig. 3 of applicant's originally filed specification.

Election/Restrictions

From Paragraph 3 of Office Action

Affirmation of this election must be made by applicant in replying to this Office action.

Applicant hereby affirms election of the invention embraced by claims 1 – 20 and 31 – 34. In view of the Interview Summary Form (PTO-413) prepared by the Examiner, applicant requests rejoinder of the process claims in the event that the Examiner determines that the product claims as amended are allowable.

Claim Rejections – 35 USC 102

From Paragraph 5 of Office Action

Claims 1 –18 and 31 – 34 are rejected under 35 U.S.C. 102(b) as being anticipated by Ovshinsky et al. (US 6,087,580).

US 6,087,580 to Ovshinsky et al. ("Ovshinsky") is directed to a non-single-crystal silicon alloy material including regions of intermediate range order (IRO) silicon alloy material. According to Ovshinsky (col. 6, lines 1 – 6): "As used herein, an intermediate range order (IRO) material shall be defined as a material having atomic aggregations of very short range periodicity, and comprised of a plurality of highly ordered, relative small atomic aggregations, typically extending no more than 50 atomic diameters." (underlining added) The IRO material of Ovshinsky is thus comprised of small atomic aggregations, each of which is highly ordered. With respect to the order of the IRO material, Ovshinsky further states (col. 4, lines 38 – 42): "The instant inventors have now found materials including any volume percent of the intermediate range order material

(i.e. the ordered clusters) will have properties which (while not necessarily decoupled) differ from materials with no intermediate range order material." (underlining added) The small atomic aggregations that define the IRO material of Ovshinsky are thus characterized as ordered clusters.

The material of Ovshinsky, in its totality, is described in Ovshinsky in the following terms (col. 4, lines 48 – 54): "The instant inventors have produced high quality non-single-crystal silicon alloy material including a volume percent of regions of intermediate range order (IRO) silicon alloy material up to, but not including the volume percentage required to form a percolation path within the material. The remainder of the material being either amorphous or a mixture of amorphous and microcrystalline materials." The material of Ovshinsky thus constitutes a combination of IRO, ordered cluster regions within an otherwise amorphous or amorphous and microcrystalline material.

The novelty in the structure of the Ovshinsky material is in the incorporation of small scale regions of a highly ordered IRO phase within an amorphous or amorphous and microcrystalline matrix up to a volume fraction of just below the percolation volume fraction. The novel properties of the Ovshinsky material result from this combination of highly ordered IRO material within surrounding material that is amorphous or amorphous and microcrystalline. According to Ovshinsky, col. 2, lines 10 – 13: "In the present invention, the advantages of crystalline and amorphous properties can be combined for those devices and applications in which periodicity is essential to the physics." Inclusion of highly ordered IRO regions in the Ovshinsky material provides the periodicity required to obtain advantageous crystalline properties in an amorphous material. The range of properties observed in the Ovshinsky material results from different spatial arrangements

of the highly ordered IRO regions within the surrounding amorphous or amorphous and microcrystalline material.

In contrast to the material of Ovshinsky where the basic unit responsible for novel structure and properties is the highly ordered, ordered cluster that defines the IRO regions, applicant's semiconductor material comprises a plurality of coordinatively irregular structures where each coordinatively irregular structure has a state of order intermediate between the crystalline and amorphous states. As stated in applicant's specification (p. 5, lines 2 – 5): "The material is an assembly of coordinatively irregular structures, each of which has a state of structural order and bonding configuration distinct from the amorphous and single crystalline forms of the semiconductor.") As further indicated in applicant's specification (p. 8, lines 14 - 19): "Since the coordinatively irregular structures possess an unusual type of chemical bonding characterized by variable distortions from regular tetrahedral coordination and a state of order intermediate between the crystalline and amorphous forms of silicon, the coordinatively irregular structures, and assembly thereof to form the ultimate semiconductor body of the present invention, possess heretofore unrealized electronic properties that are useful in a variety of devices including ...". The basic structural unit of applicant's material, a coordinatively irregular structure, is thus characterized by bonding distortions of silicon from regular tetrahedral bonding and a state of order intermediate between the crystalline and amorphous forms of silicon.

Ovshinsky fails to teach a structural unit characterized by non-tetrahedral bonding configurations whose intrinsic state of order is intermediate between the crystalline and amorphous forms of silicon and thus fails to teach applicant's coordinatively irregular

structures. Instead, Ovshinsky teaches ordered cluster, IRO regions that are highly ordered. Ovshinsky further fails to teach a material that comprises a plurality of coordinatively irregular structure as disclosed and claimed by applicant. Instead, Ovshinsky teaches a material having ordered cluster, IRO regions dispersed within an otherwise amorphous or amorphous and microcrystalline material whose properties represent a combination of the properties of crystalline and amorphous phases. The novel properties of applicant's material are not a mere combination of crystalline and amorphous properties as taught by Ovshinksy, but rather a wholly new class of properties, distinct from those of the crystalline or amorphous phases, that originate from the unusual structural distortions and bonding configurations present in the coordinatively irregular structures of applicant's material. (See applicant's specification: p. 5, lines 20 – 22: "The electronic properties of each constituent coordinatively irregular structure are determined by its state of structural order, coordination properties and bonding configuration." and also, p. 8, lines 9 – 14: "By controlling the size of constituent irregular structures, the regularity of chemical bonding within the constituent coordinatively irregular structures, the size distribution of coordinatively irregular structures within a semiconductor body, and interactions between constituent coordinatively irregular structures within a semiconductor body, it is possible to control the electronic properties of semiconductor materials with this invention.").

With respect to claims 31 – 34, applicant has rewritten the form of claim 31 in response to the Restriction Requirement made by the Examiner and has further amended claim 31 as shown above. Based on the discussion above, applicant's semiconductor

body of claims 31 – 34 is distinguished from and not anticipated by the material of Ovshinsky.

In view of the Telephonic Interview between applicant's representative and the Examiner, applicant has prepared a supporting Declaration under 37 CFR 1.132. The Declaration accompanies this response.

In accordance with the foregoing facts and discussion, applicant believes that Ovshinsky fails to anticipate applicant's material and that applicant has overcome the rejection based on Ovshinsky. Applicant respectfully requests that the rejection of applicant's claim 1 (and claims 2 – 18 which depend from claim 1) as well as applicant's claims 31 – 34 be removed.

Claim Rejections – 35 USC 103

From Paragraph 7 of Office Action

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,580).

For the reasons discussed in connection with the rejection over Ovshinsky et al. (US 6,087,580) ("Ovshinsky") under 35 U.S.C. 102 (b) above, applicant respectfully requests that this rejection be removed.

From Paragraph 8 of Office Action

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,580) as applied to claim 1 above, in view of Tsuo et al. (US 5,627,081).

For the reasons discussed in connection with the rejection over Ovshinsky et al. (US 6,087,580) ("Ovshinsky") under 35 U.S.C. 102 (b) above, applicant respectfully requests that this rejection be removed.

Claim Rejections – Double Patenting

From Paragraph 10 of Office Action

Claims 1 – 18 and 31 – 34 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 18 of U.S. Patent No. 6,087,580.

For the reasons discussed in connection with the rejection over Ovshinsky et al. (US 6,087,580) ("Ovshinsky") under 35 U.S.C. 102 (b) above, applicant believes that applicant's claims are patentably distinct from those of Ovshinsky and respectfully requests that this rejection be removed.

SUMMARY

In view of the above amendment and the Examiner's restriction requirement, the remaining claims in the application are claims 1 – 20, and 31 – 38. In view of the above amendment and accompanying remarks, applicant believes that the remaining claims are allowable over the references cited by the Examiner. Applicant respectfully requests withdrawal of the outstanding rejections and notification of allowance. Should the Examiner have any questions or suggestions regarding this amendment or applicant's prosecution of this application, he is respectfully asked to contact applicant's representative at the telephone number or email address listed below.

Respectfully submitted,

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